



RECORD BREAKER — A solar dish Stirling system, like the one seen here at Sandia's Solar Thermal Test Facility, has set a new world record for Sandia and industry partner Stirling Energy Systems. The record,

attained on a perfect New Mexico day last month, establishes a new solar-to-grid conversion efficiency of 31.25 percent. The old record, which has stood since 1984, was 29.4 percent. (Photo by Randy Montoya)

Sandia, SES set new world record for solar-to-grid efficiency

31.25 percent efficiency rate topples 1984 record

By Chris Burroughs

On a perfect New Mexico winter day — with the sky almost 10 percent brighter than usual — Sandia and Stirling Energy Systems (SES) set a new solar-to-grid system conversion efficiency record by achieving a 31.25 percent net efficiency rate. The old 1984 record of 29.4 percent was toppled Jan. 31 on SES's "Serial #3" solar dish Stirling system at Sandia's National Solar Thermal Test Facility.

The conversion efficiency is calculated by measuring the net energy delivered to the grid and dividing it by the solar energy hitting the dish mirrors. Auxiliary loads, such as water pumps, computers, and tracking motors, are accounted for in the net power measurement.

"Gaining two whole points of conversion efficiency in this type of system is phenomenal," says Bruce Osborn, SES president and CEO. "This is a significant advancement that takes our dish engine systems well beyond the capacities of any other solar

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"Gaining two whole points of conversion efficiency in this type of system is phenomenal."

— SES President and CEO
Bruce Osborn

New protection methods keep labs' mobile devices mobile

By Charles Shirley



JASON ORTIZ, a member of Sandia's CSU team, with a Sandia laptop. New measures are being put in place to make laptops more secure on travel.

(Photo by Randy Montoya)

Imagine not being able to take a laptop computer, personal digital assistant, or even a flash drive containing a few documents outside the Sandia fences.

Because of broadly publicized incidents in which personal information was compromised when laptops or other hardware was lost or stolen, DOE was considering a ban on removing any mobile device from DOE sites, says Sandia Chief Information Officer Art Hale (9600).

Sandia and its sister labs Los Alamos and Lawrence Livermore

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Moving into an era of broader national security engagement

Tom Hunter's all-hands meeting focuses on future

Note: On Feb. 6, Labs Director Tom Hunter conducted the first all-hands meeting of 2008. The hour-and-a-half session began with Tom citing a number of key accomplishments from FY07 and noting that FY08 looks to be an "extremely exciting time" to provide exceptional service in the national interest. Tom's all-hands included about 65 minutes of prepared remarks and 25 minutes of questions and answers. The following story highlights just a few of the key subjects addressed by Tom. To hear his comments in their full context and complete detail, go to the video of his presentation at <http://ln.sandia.gov/Hunter-Feb-2008>.

In his first all-hands meeting of 2008, Sandia President and Labs Director Tom Hunter addressed critical mission and operational issues Sandia will be dealing with over the next few years. The all-hands meeting, held Feb. 6 in the Steve Schiff Auditorium, attracted a full house of Sandians and was viewed via video link at other Sandia sites around the country.

Tom noted that the evolving national security environment poses challenges the Labs' leadership has addressed in the current strategic plan.

"Each of our two strategic management groups — Nuclear Weapons and Integrated Technologies and Systems — has mapped out a strategic future, which is spelled out in the strategic plan. It basically says we will move the nuclear weapons complex into a new posture and that the national laboratories will be moving into the broader arena of national security." In that role, Tom said, the national laboratories will not only carry on with their traditional nuclear weapons mission but also will increasingly apply their capabilities to a broad set of

(Continued on page 5)



LABS DIRECTOR TOM HUNTER

(Photo by Randy Montoya)



National Engineers Week is Feb. 17-23

In observance of National Engineers Week, celebrated this year Feb. 17-23, the *Lab News* asked Executive VP and Deputy Labs Director John Stichman to write about a subject that is very close to him — that is, the importance of ethics in engineering. John's article is based on his Sandia Technology Symposium presentation: An Ethical Imperative — Drawn from Engineering Mishaps. See John's story on pages 6-7.



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That's that

The other day I went through a routine medical procedure, which in the interest of delicacy I won't describe in any detail. Suffice it to say that this particular procedure has been called a "rite of passage" for 50-somethings. Those of you who were born before Sputnik was launched probably know what I'm talking about. For the rest of you, well, you'll find out soon enough.

The procedure itself is innocuous enough; it really is routine. A bit more problematic is the prep for the procedure. The instruction sheet I got from my doctor said that starting three days before said procedure I was not to ingest any fruit or vegetables. I was especially cautioned not to eat anything containing seeds. So far, so good.

What grabbed my attention was the next admonition. Do not, under any circumstances (it said) eat any green chile. And I thought to myself, only in New Mexico would you see a note like that. Someone from away would read that warning and shrug it off as a harmless bit of local eccentricity. No big deal. Of course, we New Mexicans know that it's not as simple as that.

"No green chile" basically means: no breakfast ('cause you've gotta have green chile with your scrambled eggs or breakfast burritos); no lunch (because you just can't bring yourself to eat a hamburger sans chile verde); and — especially in this bleak midwinter — no supper (because when it's this cold for this long, all you want to do is eat green chile stew by the gallon).

But I'm a good soldier, and I sure didn't want to go through this process twice, so I followed the prep instructions to the letter. And, per those instructions, I didn't eat a single thing in the 24 hours leading up to the procedure. (I won't talk here about the gunk you have to drink . . . or why.)

The procedure itself? I was out cold and that's fine with me. When I woke up, I was hungry as all get-out. After getting a debrief from the doctor, my wife was there to drive me home. We got about a mile down the road when I suddenly — and probably rather alarmingly — insisted that she take a quick right. Into one of those familiar red-and-white tiled hamburger stands. I just had to have a green chile and cheese Lotaburger. Best I ever had.

* * *

Our next issue of the *Lab News* will be something special. We won't be mailing out the regular newspaper. In its stead, we're distributing our annual *Labs Accomplishments* publication. In my humble and totally unbiased view, it's the best single summary of Sandia's work that you'll find anywhere. When you look through its 12 colorful pages and see the full breadth and depth of the work we do for the nation, I think you'll agree that we are unique in all the world. No place else does everything we do. Or does it nearly as well. What it comes down to — and what this *Labs Accomplishments* issue demonstrates — is that if it's related to this nation's security, and if there's a technical component to it, you can bet that we're involved in it one way or another.

* * *

A note related to the above: Because we won't be doing a regular *Lab News* for Feb. 29, we won't be doing a classified ad page. The next issue that will include ads will be March 14. The ad deadline for that issue is noon on March 7.

See you next time.

— Bill Murphy (505-845-0845, MS0165, wtmurph@sandia.gov)

Latest winners named in Environmental Management System Excellence Awards

The EMS Excellence Awards recognize exemplary advancements by individuals or teams that contribute to the vision of Sandia's Environmental Management System in the following ways:

- Implementing and maintaining a prevention-based system beyond compliance,
- Providing value-added service to line customers,
- Continuously improving Sandia's environmental performance, and
- Gaining customer, stakeholder, and public recognition of Sandia's environmental achievements.

A ceremony recognizing the latest recipients of the EMS awards was held in late January. The winners, drawn from 10 nominations in four categories, are:

Water Conservation/Energy Reduction (tie): Dust Suppression — the Grounds and Roads Services group with help from System Engineering group; and the Distributed Energy Test Laboratory (DETL) Bldg. 833

Risk Mitigation/Environmental Protection: Putting EMS to Work-Lean Manufacturing — Div. 2000, Weapons Engineering and Product Realization

Waste Minimization: Getting the Lead Out, a team made up of Sandia technologists, a manager, and an industrial hygienist

Recycling: Recycling at the Airworthiness Assurance Non-Destructive Inspection Validation Center (AANC) facility — Dept. 6416.

For a detailed listing of all award nominations, visit the EMS website. The next round of EMS nominations will kick off on April 1. Nominations are due July 1 with awards to be presented at an event in late July.

Recent Patents

Note: Patents listed here include the names of active Sandians only; former Sandians and non-Sandia inventors are not included. Following the listing for each patent is a patent number, which is searchable at the US Patent and Trademark Office website (www.uspto.gov).

Stanley Kravitz (1717) and Nelson Bell (1816): Method of Generating Hydrogen Gas from Sodium Borohydride (Patent No. 7,306,780)

Carl Hayden (8353) and Dave Chandler (8350): Fast Time-Correlated Multi-Element Photon Detector and Method (Patent No. 7,310,142)

Ron Renzi (8125): Capillary Interconnect Device (Patent No. 7,311,882)

Changes in store for SDN

On Thursday, Feb. 14, *Sandia Daily News* will launch its new website and online submission form. Sandians will receive SDN in their email as usual, but the submission process will change. Sandians are to submit items to SDN using an online form — the URL for that website is <http://www-irn.sandia.gov/newscenter/sdn>.

Submissions will no longer be accepted to the *Daily News* email account. These changes are designed to improve the efficiency of producing SDN, update its appearance, and improve the searchability of past issues. We ask for your patience during this transition process and welcome your feedback.

— Julie Hall (3651), jchall@sandia.gov, 505-284-7761

Deadline change for classified ads

The next regular issue of the *Lab News* will be March 14. Instead of our regular issue of the *Lab News*, we'll be delivering the annual *Labs Accomplishments* publication, which does not feature a classified ad page. The classified ads will return with that first issue in March. The deadline for submitting ads for that issue will be March 7 at noon.

Retiree deaths

James R. Meikle (age 85)	Dec. 4
Santiago Anaya (94)	Dec. 13
August E. Binder (81)	Dec. 13
Juan B. Ortiz (90)	Dec. 14
David L. Bailey (89)	Dec. 17
Gilbert Atencio (94)	Dec. 23
Robert W. Freeze (79)	Dec. 25
Phillip E. Eyer (91)	Dec. 30
William E. Packer (60)	Jan. 1
William F. Moyle (86)	Jan. 3
Rosalie F. Crawford (84)	Jan. 8
Greg A. Abeyta (89)	Jan. 8
Richard L. Starkey (79)	Jan. 11
Rubel Romero (86)	Jan. 14

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Sandia National Laboratories

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Others:

To receive the *Lab News* or to change the address (except retirees), contact Michelle Fleming, Media Relations and Communications Dept. 3651, 505-844-4902, email meflemi@sandia.gov, or Mail Stop 0165, Sandia National Laboratories, Albuquerque, NM 87185-0165.

Employees:

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Web users:

The *Lab News* is on the external web at www.sandia.gov/LabNews.

On the internal web, go to:

<https://www-irn.sandia.gov/newscenter/interactive>

Fresh off innovative 'bionic contact lens' project, Harvey Ho brings growing reputation to Sandia

By Patti Koning

A surgeon is in the middle of a complicated procedure and doesn't want to take his eyes away from his patient. He doesn't have to — thanks to a bionic contact lens that displays the patient's vitals in his field of vision.

Or, imagine a driver who doesn't need to look away from the road to see critical information because it's projected onto his windshield. Another scenario is a diabetic who sees an LED flash in the corner of his eye when his glucose levels begin to drop.

That might sound like the stuff of science fiction, but not to Harvey Ho, who was hired in September to the Surety Design Engineering Dept. 8226 at Sandia/California. Last year Harvey completed his MS in electrical engineering at the University of Washington (UW) under Babak Parviz, an assistant professor of electrical engineering.

For his master's thesis, Harvey designed the circuitry that would go around display elements, such as LEDs for what is being referred to as the "bionic contact lens." He presented the results at the Institute of Electrical and Electronics Engineers' international conference on microelectromechanical systems last month.

Building the contact lenses posed a technical challenge because materials that are safe for use in the body, such as the flexible organic materials used in contact lenses, are delicate. Manufacturing electrical circuits, however, involves inorganic materials, scorching temperatures, and toxic chemicals.

Harvey and other researchers built the circuits from layers of metal only a few nanometers thick, about one-thousandth the width of a human hair, and constructed light-emitting diodes one-third of a millimeter across. They then sprinkled the grayish powder of electrical components onto a sheet of flexible plastic. The shape of each tiny component dictates which piece it can attach to, a micro-fabrication technique known as self-assembly. Capillary forces — like those that make water move up a plant's roots and that cause the edge of



HARVEY HO
(Photo by Dino Vournas)



EYE MASTER — Harvey Ho, a recent hire, designed the electric circuits on the "bionic" contact lens (shown here) for his master's thesis. (Photo by Harvey Ho)

a glass of water to curve upward — pull the pieces into position.

Harvey began working with Parviz as an undergraduate at UW. Math and science interested him from a young age.

Always interested in how things work

"I grew up surrounded by technology, always very interested in how things work," he says. "In high school I had some great physics and math teachers who put me on the scientific track."

The project, now in prototype stage, recently garnered media attention from the likes of *National Geographic News*, *The Economist*, CNBC columnist Bryn Nelson, *Science Daily*, CNET, *Seattle Post-Intelligencer*, *EETimes*, Fox News, and technology bloggers worldwide.

At just 24 years old, Harvey has attained the type

of high-profile accomplishment many researchers dream about. "I did feel I was working in something cutting edge, something that kept me going when I worked in the lab late into the night," he says. "I feel like I have contributed something meaningful to the field of electrical engineering."

Parviz describes Harvey as a solid engineer who can make things happen.

"He is completely self-motivated and always ready to explore new things," Parviz says. "Harvey is an asset to any company or organization that is fortunate enough to have him onboard."

Coming to Sandia represents the next step in his career. He was attracted by the variety of research and top-notch facilities such as MESA. "It's not quite academia, but not quite industry," he says. "You can draw upon a lot of different people from many different disciplines."

Sandia California News

Sandia/California named winner of Environmental Spirit Award by Livermore Chamber of Commerce



WELL DONE — Jim Ott, president and CEO of UNCLE Credit Union and a board member of the Livermore Chamber of Commerce, presents Gary Shamber (8516) with the Chamber's Environmental Spirit Award. (Photo by Randy Wong)

By Mike Janes

Sandia/California has been selected by the Livermore Chamber of Commerce as recipient of its inaugural Environmental Spirit Award. The award was presented to Sandia for its environmental programs and ongoing commitment to protecting the environment and wildlife on the laboratory's 400-acre site, says Dale Kaye, chamber president and CEO.

"Sandia has not only shown tremendous sensitivity to the land it occupies, but also a dedicated commitment to its community," says Kaye. "This is an organization that helps to protect our world and we are delighted to be able to present them with this award."

Gary Shamber (8516), manager of the site's environmental management department, considers environmental stewardship to be a fundamental obligation shared by all Sandia employees and staff.

"Many of our program objectives have been specifically designed to not only minimize our environmental impacts in the local community but also to preserve the natural environment and resources that we share," he says.

Sandia was presented with the award during the

Livermore Chamber of Commerce annual Installation and Community Awards Gala Feb. 2. In his acceptance speech on behalf of Sandia, Gary emphasized the growing importance of environmental stewardship by individuals, companies, and communities.

"When one considers the state of our planet it is evident that we all have much work to do to correct the ills of the past and the undesirable trends of the present," he says. "As a Native American proverb says, 'We do not inherit the earth from our ancestors, we borrow it from our children.'"

Last spring Sandia/California won a DOE Pollution Prevention (P2) Star Award for the implementation of the site's Environmental Management System (EMS). The site's EMS has been ISO 14001-certified since September 2006.

The International Standards Organization (ISO) specifies the requirements for state-of-the-art products, services, and managerial and organizational practice. ISO 14001 is a system that requires an environmental policy; objectives and targets; programs for implementation, monitoring, and measurement; preventive and corrective actions; involvement at all levels; and continuous improvement.

Sandians demonstrate verve in transferring Labs technology to private sector

Four awards from Federal Laboratory Consortium exceed in number every other federal lab

By Neal Singer

Three Sandia research teams and one Sandia executive have won national awards for their skills in making technology transfer happen.

Team trophies and individual leather-bound certificates will be provided to 2007 winners on May 8 in Portland, Ore., by the Federal Laboratory Consortium (FLC), the nationwide network that helps link federal laboratory technologies with the marketplace.

The four awards (one was joint) were the most won by any national lab. Pacific Northwest National Lab won three.

David Goldheim, director of Sandia's Strategic Relationships Center from 1999 to 2007, received the Outstanding Technology Transfer Professional award.

Sandia's "ElectroNeedle Biomedical Sensor Array" and the "Secure Sensor and Seal Technologies for Global Nuclear Non-proliferation" won Excellence in Technology Transfer awards.

Also winning an Excellence in Technology Transfer award, in a joint submission with the Naval Research Laboratory, was the "Helical Fiber Amplifier."

Nominations are judged by a panel of experts from

industry, state and local government, academia, and the federal laboratory system.

The FLC, organized in 1974, according to its own description "develops and tests transfer methods, addresses barriers to the process, provides training, highlights grass-roots transfer efforts, and emphasizes national initiatives where technology transfer has a role."

Says David, "They also publicize the value of technology commercialization in national and regional forums."

All entrants either win an award or are presented an "Honorable Mention."

Applications for the awards were coordinated by Margaret Lovell (0304) and Jackie Kirby Moore (1033).

FLC: THE WINNERS' CIRCLE

• **Secure Sensor** — Barry Schoeneman (6722), Brent Burdick (1031), Steve Blankenau (5356)

Sandia was able to transfer technology for the T-1A optical seal, an active radio frequency (RF)-based device used to monitor high-value assets, and its technological successor, the Secure Sensor Platform (SSP).

The T-1A seal makes it highly difficult to remove material or containers without breaking the seal on the fiber optic loop. These seals are intended for long-term use without maintenance for up to five years on one battery.

Sandia initiated an industrial partnership by proposing that Canberra Albuquerque commercialize the T-1A and collaborate on the development of the SSP. The innovative transfer combined a license agreement for the current T-1A sensor with a CRADA

to jointly develop the next generation SSP sensor. Not only was the current T-1A product brought to market successfully through the licensing of Sandia intellectual property, but the CRADA will provide a streamlined commercial launch of the SSP sensor. The transfer for the SSP has been funded entirely by Canberra. The pro-

(Continued on next page)



Solar record

(Continued from page 1)

dish collectors and one step closer to commercializing an affordable system."

Serial #3 was erected in May 2005 as part of a prototype six-dish Model Power Plant at the Solar Thermal Test Facility that produces up to 150 kilowatts (kW) of grid-ready electrical power during the day. Each dish unit consists of 82 mirrors formed in a parabolic dish shape to focus the light to an intense beam.

The solar dish generates electricity by focusing the sun's rays onto a receiver, which transmits the heat energy to a Stirling engine. The engine is a sealed system filled with hydrogen. As the gas heats and cools, its pressure rises and falls. The change in pressure drives the pistons inside the engine, producing mechanical power, which in turn drives a generator and makes electricity.

Lead Sandia project engineer Chuck Andraka (6337) says that several technical advancements to the systems made jointly by SES and Sandia led to the record-breaking solar-to-grid conversion efficiency. SES owns the dishes and all the hardware. Sandia provides technical and analytical support to SES in a relationship that dates back more than 10 years.

Chuck says the first and probably most important advancement was improved optics. The Stirling dishes are made with a low iron glass with a silver backing that make them highly reflective — focusing as much as 94

About SES

Stirling Energy Systems (SES) was formed in 1996 to develop and commercialize advanced concentrating solar technology. The company maintains its corporate headquarters in Phoenix, Ariz., project and technical development offices in Tustin, Calif., and engineering and test site operations at Sandia.

percent of the sunlight to the engine package, where prior efforts reflected about 91 percent. The mirror facets, patented by Sandia and Paneltec Corp. of Lafayette, Colo., are highly accurate and have minimal imperfections in shape.

Both improvements allow for the loss-control aperture to be reduced to seven inches in diameter — meaning light is highly concentrated as it enters the receiver.

A 'perfect storm' of sorts

Other advancements to the solar dish-engine system that helped Sandia and SES beat the energy conversion record were a new, more effective radiator that also costs less to build and a new high-efficiency generator.

While all the enhancements led to a better system, one aspect made it happen on a beautiful New Mexico winter day — the weather.

"It was a 'perfect storm' of sorts," Chuck says. "We set the record on Jan. 31, a very cold and extremely bright day, a day eight percent brighter than normal."

The temperature, which hovered around freezing, allowed the cold portion of the engine to operate at about 23 degrees C, and the brightness meant more energy was produced while most parasitic loads and losses are constant.

The test ran for two and a half hours, and a 60-minute running average was used to evaluate the power and efficiency data, in order to eliminate transient effects. During the testing phase, the system produced 26.75 kW net electrical power.

Osborn says that SES is working to commercialize the record-performing system and has signed power purchase agreements with two major Southern California utilities (Southern California Edison and San Diego Gas & Electric) for up to 1,750 megawatts (MW) of power, representing the world's two largest solar power contracts ever granted. Collectively, these contracts require up to 70,000 solar dish engine units.

"This exciting record shows that using these dishes will be a cost-effective and environmentally friendly way of producing power," Osborn says. "SES is actively engaged in the commercialization of a system, called the 'SunCatcher,' including continuing to prepare it for mass production, completing project site development and preconstruction activities, and establishing partnerships with substantial manufacturing and industrial organizations to develop a cost-effective manufacturing process and supply chain. The demonstrated high efficiency means more energy is generated for the given investment, lowering the cost of the energy delivered."

Laptop policy

(Continued from page 1)

came up with an alternative.

The labs will certify that laptop computers serve an official business need; encrypt sensitive information; justify the need to take a laptop off-site; and, during foreign travel or extended assignment outside the US, use laptops from a special pool.

New software protects automatically

New encryption software, which will render sensitive information useless even if hardware is lost, is coming first to Sandia's Windows laptops. Other laptop and desktop computers will be included in later phases, says Art. Although the lab directors' letter explicitly addresses only laptop computers, the same principles will apply to mobile devices such as personal digital assistants and USB flash drives.

The first Windows laptop users began receiving

emailed instructions for installing Credant Mobile Guardian (CMG) Shield last month. "We're starting the deployment gradually and will get to everyone before long," says Scott Rogers (9343), a CSU project manager and chair of the CSU Deployment Team that tests proposed Labs-wide software. "The gradual approach builds up our experience with supporting CMG Shield on laptops in a wide variety of user situations."

Once installed, the software automatically encrypts the data on a computer's hard drive and also protects removable storage devices such as USB flash drives and external hard drives.

"CMG Shield fills gaps left by our current tool, Entrust," says Barry Hess (9610), Deputy CIO for Information Systems. "Its biggest advantage is that once it's installed, you don't have to take additional action to encrypt data on your hard drive. We will still need Entrust to encrypt email messages and attachments."

Formal policy changes are in process that will clarify what protection is required for all Sandia mobile computing and storage devices.

Further information is available at <http://csu.sandia.gov/Credant>.

Laptop certification coming soon

Employees whose work requires a laptop will use an online tool to enter their justification for having a laptop and, if applicable, for taking the laptop off-site. Their immediate managers will approve or disapprove with the same tool.

This requirement will be phased in, with some laptop owners beginning to receive notifications later this month.

LOFT already in full swing

For several years, Sandia has had a project called Laptops on Foreign Travel. LOFT's hardware and access procedures protect Sandia from threats introduced by using computers and related devices abroad. In addition to laptops, LOFT offers foreign travelers BlackBerrys and flash or external drives, as well as safe access to email, timecard, and similar corporate tools.

About LOFT, Div. 4000 VP Mike Hazen, Sandia's Chief Protection Officer, says, "I very much appreciate the support of LOFT, an important information protection initiative and enhancement. The CIO and his staff have done a fantastic job meeting the needs of our travelers while improving the security of our critical information."

Mike issued a memo in December directing all foreign travelers to use LOFT. (The LOFT website is at <http://loft.sandia.gov/>.)

"Because of all these capabilities," says Art, "the Sandia workforce will continue to have tools to do their jobs both on and off Sandia premises. We may sometimes perceive security as a requirement that restrains our freedom. The new approaches to protection clearly ensure our freedom to continue doing many things that increase Sandia's productivity and, often, make our individual jobs easier."

Laptop policy team members

Robbie Evanoff, Sam Jones, Matt Snitchler, Tony Valencia (all 9342), Charles Cote, Susan Sackinger (both 9343), Jim Chapek (6750), John Lewis (9312), Kevin Nauer (9317), David White (9510), and Jonathan Mandeville (9343)

All-hands meeting

(Continued from page 1)

national security customers.

"Joan and Al and Les and Paul and Jerry McDowell all are spending time each day meeting these strategic objectives," Tom said, referring, respectively, to Deputy Labs Director for Nuclear Weapons Joan Woodard; Deputy Labs Director for Integrated Technologies and Systems Al Romig; Energy, Resources, and Nonproliferation SMU VP Les Shephard; Homeland Security and Defense SMU VP Paul Hommert; and Defense Systems and Assessments SMU VP Jerry McDowell.

Regarding the broader role of the national labs, Tom said he and the other lab directors are working with DOE to ensure that partnering with other national security customers is "not just tolerated but encouraged."

"This is very much the mantra that Sandia has taken up over the past several years," and amounts to the formalization of a trend that is already apparent, Tom said.

In another area, Tom reported that Sandia's workforce restructuring process has been proceeding over the past several months according to plan.

Tom noted that local media coverage of the federal budget process has suggested that Sandia's workforce sizing decisions were being driven — at least to some extent — by the widely reported ups and downs of the budget process in Washington. That was not the case, Tom emphasized.

"In August of last year we laid out the Laboratory plan, we committed to it, we staffed and sized the Laboratory and laid out the hiring program according to it — and that plan has not changed at all," Tom said. "We never assumed we'd have the budget that was proposed by the Senate or by the president. We made an assessment about where it [the budget] would be." That assess-

9/80 here to stay . . . if Sandians respect the rules

During his Feb. 6 all-hands meeting Labs Director Tom Hunter addressed a number of issues on Sandians' minds. The 9/80 issue, for example, has been the subject of watercooler talk around the Labs. The initial issue of 9/80 was raised due to some technicalities in the way hours are recorded for nonexempt employees on the Fridays that they work. Tom said Sandia is working with the US Department of Labor to address that specific issue. "We're going to try and keep the 9/80 work schedule; this is just something we have to work through with the Department of Labor."

On the broader issue of 9/80 as it applies to all employees, Tom assured the audience that management recognizes and values 9/80 as an important work/life benefit. However, the Labs has a responsibility to ensure that employees actually work the hours they claim.

"We must ensure that abuses of the schedule don't occur," he said, "and we must ensure that all the functions of the Labs work five days a week. . . . It's a matter of integrity that we do it right."

ment has proven to be very close to the budget as ultimately approved by Congress.

The intent of Labs leadership, said Tom, is to reduce costs by reducing the size of the Laboratory — most notably, the indirect workforce — through attrition.

But why reduce the costs at all? Tom said a number of looming cost increases stand poised to impact Sandia's cost of doing business. Those costs must be addressed. For example, Tom said that in 2011 the Labs will probably be required to start paying into the pension fund. "We haven't paid into the fund since 1986. That [new cost] alone could increase the cost of doing business by about 10 percent. . . . No one gives us more money to pay for that pension. No one says, 'Here's more money because you have more costs.' They say, 'Here's the same money you expected; you figure out how to deal with

the costs.' Simply put, we don't want to wait until 2011 and say, 'Oh, we have to reduce the workforce by 10 percent so that we can pay the pension for the 90 percent who are still here.' Our plan is, over time, to evolve down to where we get the annual cost savings to where we need them. We're on that path, and that is exactly the reason for all the discussion we've had about workforce restructuring this year."

Cost control is the key

Tom cited other increasing costs: Medical costs are increasing (although Tom lauded Sandia's Benefits team for keeping Sandia medical cost increases below the national average through smart management) and investment funds will be needed for infrastructure improvements that in the past might have been paid for by NNSA.

These are future cost drivers that Sandia must be prepared to deal with by starting to reduce indirect costs today, Tom said.

"It won't be painless; everyone is seeing it. . . . Hopefully the workforce impacts will be such that we can do this almost entirely by attrition because this is almost an attrition-based model out to 2011. So, with forethought we're doing this; this is the sole contributor to any workforce impact we had in fiscal '08."

Since 2006, he said, the hiring program (in the 300 per year range) has been below the attrition rate. The result is a laboratory that is getting smaller incrementally and by design.

In another area, Tom noted that changes in Washington will have a bearing on the work the Labs is asked to do over the next few years. Broad changes at the executive and legislative levels — there will be a new administration, with new cabinet officers, and an almost entirely new New Mexico congressional delegation (a year from now only Sen. Jeff Bingaman will be in the same post he now holds) — mean that new relationships, new priorities, and new expectations will be the order of the day.

Through all of these changes, Tom said, our charge will be to "render our service to the country in a consistent manner."

Red Storm to be upgraded from 124 to 284 teraflops

By Neal Singer

Sandia's Red Storm supercomputer is expected to be upgraded this summer from 124 teraflops to 284 teraflops. A teraflop equals one trillion arithmetic operations per second.

The computational restructuring is made possible by new technology that allows a quad-core — that is, four processors — to be inserted on a surface that currently houses a dual processor.

The performance boost will increase the resolution of Sandia computer simulations.

Sandia researchers originally designed Red Storm with Cray Inc. as part of a contract under NNSA's Office of Advanced Simulation and Computing (ASC).

The design is the basis for the highly scalable and widely successful line of massively parallel processor supercomputers that have been installed at 21 sites around the world. "More than 35 systems have been sold based on the Red Storm design," says Sandia computer architect James Tomkins (1420).

The upgrade, scheduled to take place this summer, will include integrating Quad Core AMD Opteron™ processors into a substantial portion of the system as well as increasing the available memory to 2 gigabytes per processor core for all of the compute nodes. (A gigabyte is a billion bytes.)

Observes James Peery, director of Sandia Computations, Computers, and Math Center (1400), "Red Storm continues to be heavily utilized by all three NNSA labs. Demand for the machine greatly exceeds the available cycles. We've been able to prioritize and solve several critical national security problems that required the use of the entire machine. However, there still remains a backlog of almost a year of simulation."

Parallel processing in the early 1990s referred to a then-new method that allowed relatively slow computer processors to work together to solve problems faster than could a single very fast processor. Sandia was an early pioneer in the development and application of massively parallel computing technology and partnered with Intel to create the world's first teraflop supercomputer, ASCI Red.

"We need more computing capability because we're putting more physics in our computer codes, and we need greater capacity to run large numbers of simulations for uncertainty quantification," says Sudip Dosanjh (1420), who heads Sandia's computer science research efforts. "This upgrade will also help us prepare for the future because we expect the number of microprocessor cores to grow exponentially in the future."

"We're pleased to continue our successful partnership with Cray," says Robert Meisner, deputy director of ASC at the NNSA. "The more than twofold increase in computing power provided by this upgrade will provide important capacity for tackling national security problems."



FLC awards

(Continued from preceding page)

duction of the T-1A units is funded primarily by Canberra with some minimal funding provided by DOE's Savannah River Site (SRS) as the domestic customer for the seal. All technology transfer efforts and the associated costs of negotiating and executing the CRADA and license agreement were assumed by the Strategic Relationships Center at Sandia.

• **ElectroNeedle** — Paul Smith (1031), Chris Apblett (1815), Carrie Schmidt (1717), Kerry Kampschmidt (11700), Brent Burdick (1031), Steve Casalnuovo (1714), Kent Schubert (1717), David Ingersoll (2546), Stan Kravitz (retired), Jeb Flemming (former Sandian), and Collin Buckley (former Sandian)



The ElectroNeedle™ Bio-medical Sensor Array is a device that, when pressed against the skin, will provide rapid, on-demand, multiplexed, point-of-care biomedical assays for medical diagnosis in emergency, battlefield, and remote settings where time constraints or distance make it impractical to send the patient's samples to a conventional laboratory for analysis. It will also eliminate delays experienced by many patients and physicians in waiting for diagnostic test results.

Two new biotechnology companies — New Mexico Biotech Inc. and Life BioScience Inc. — have been formed in Albuquerque explicitly for ElectroNeedle commercialization. One company has already licensed the IP portfolio that became available during 2006 and negotiations are underway with the second. Sandia will provide ongoing research into the technology and technical guidance to the licensing organizations. The licensee(s) are expected to develop the commercial product, to pursue FDA approval for the product, and to provide funding to Sandia for continued R&D.

• **Helical Fiber Amp** — Jeffrey Koplou (8368), Dahv Kliner (8368)

Researchers affiliated with the Naval Research Laboratory and Sandia developed a method that uses bend loss (coiling) to selectively suppress undesirable modes in a fiber amplifier, thereby making high-power fiber lasers possible. The solution resolved power limitations of fiber lasers that had stymied the industry since fiber lasers were first developed in 1963, while preserving high beam-quality output. The groundbreaking discov-

ery now allows production of high-power fiber lasers that are more efficient, cost-effective, rugged, and compact than other types of lasers.



By 2006, all three companies had received patent licenses allowing use of the innovative technology in their laser-based product lines, and two subsequent licenses have since been issued.

• **David Goldheim** was praised for his "leadership, inventiveness, and tenacity in developing and shepherding innovative programs that support Sandia's business development and strategic intellectual property (IP) management efforts." Examples of innovative mechanisms attributed to David's initiative or support include the Business Intelligence/Market Research team's use of powerful software to identify potential relationships based on common technology interests, corporate strategies, and business models; Equity Sharing Program, which accepts equity instead of cash royalties from companies that license Sandia intellectual property; Royalty Sharing Program, which distributed \$3.4 million to Sandians in 2006; Technology Maturation Fund, which uses funds from the Royalty Sharing Program to help prepare nearly ready technologies for marketing; Mission Centric Venturing, aiding maturation of technologies seen as crucial to Sandia; Entrepreneurial Separation to Transfer Technology, which provides a safe return for Sandians who venture out into the business world to commercialize their technologies; Entrepreneur-in-Residence; Sandia Science & Technology Park, the 200+ acre development east of Kirtland; New Mexico Small Business Assistance Program, which took over for DOE's now-defunct Technology Partnerships Program and offers an avenue for the Labs to help small businesses; and the Shared Vision program (a collaborative technology development and maturation program with Lockheed Martin).



DAVID GOLDHEIM

An ethical imperative for engineers

Note: In observance of National Engineers Week, celebrated this year Feb. 17-23, the Lab News asked Executive VP and Deputy Labs Director John Stichman to write about a subject that is very close to him — that is, the importance of ethics in engineering. John's article here is based on his Sandia Technology Symposium presentation: *An Ethical Imperative — Drawn from Engineering Mishaps*. You can see the presentation at <http://ln.sandia.gov/engineering-ethics>.

To "engineer" is to create and to create according to a professional discipline. In fact, the term "engineer" goes all the way back to the Latin *ingeniarius* and the *-gen-* part of the word traces to the Greek term for "create." Yes, "engineer" has roots that relate to terms we recognize, like "genesis" and "ingenious."

We engineers would do well, then, to be mindful that what we create — our products, hardware or software, large or small, are new additions to our world. They are things that have not existed before, at least not in their particular form or placement or usage. And human experience teaches us this: That which is new will also have unforeseen consequences.

Mary Shelley's classic book *Frankenstein* offers us an allegory on the unintended consequences of a creative endeavor. In the book, Victor Frankenstein experiences exhilaration and triumph as his creation stirs to life. Very soon, however, things begin to go terribly wrong. As the behavior of the Creature goes awry, Victor is consumed with trying to find a solution to what he has done. A particularly telling point in the story occurs when Victor and the Creature come face to face, and the

Creature says, "You are my creator, but I am your master."

As professionals, we engineers are expected to have and use special knowledge in serving a beneficial societal need. In doing so, we are expected to obey the moral minimum — "first of all, do no harm." Each major discipline within engineering has a code of ethics to help us to govern our actions, and these can be viewed and studied by going to their respective websites or other materials.

Still, there is one very basic ethical imperative that is not typically discussed, yet is at the very foundation of good, sound engineering: Take positive steps to avoid avoidable errors.

Norman Augustine, the former CEO of Lockheed Martin and former chair of the National Academy of Engineering Council, has said "Engineers who make bad decisions often don't realize that they are confronting ethical issues." Yet, it is all too true that an engineering error can pose risk to life and limb, jeopardize a critical mission, or wreak economic havoc.

The above imperative is easy to say, even obvious in concept, but what does it mean in the day-to-day practice of our profession?

Like many other engineers, I have tried to learn lessons from the misadventures of others. Humbly, I offer some maxims for achieving the imperative and some discussion of the incidents that inspired these maxims.

By John Stichman

1. Demonstrate utter integrity with respect to the engineered object

Consider the Swedish warship, the *Vasa*. In 1628, Sweden was a major European power, and King Gustavus Adolphus had commissioned a warship to showcase this power for all to see.

During construction, the developers feared the ship would be prone to capsizing, so they ran a test, having soldiers run back and forth across the deck. The ship rocked so much that the test was stopped. But the king really wanted the ship, so the developers ignored the test and finished the ship. It sank after sailing only a nautical mile, with great loss of life.



KING GUSTAVUS ADOLPHUS wanted his warship, *Vasa*, to join the Swedish fleet. Engineers allowed the king's wishes to trump their own best judgment. Disaster ensued.

The saga of the *Vasa* offers us an example of "ballistic thinking" rather than "critical thinking." When we think ballistically, we are essentially bound on a fixed trajectory, ignoring information that would correct our path to our "target."

When we run a test, we are asking a question of our product, and it behooves us to listen to its answer. We must be extraordinarily evenhanded in doing so, because there are often great forces, as in the case of the *Vasa*, that

would have us do otherwise. In any case, we must not let the desirability of a successful outcome cloud our engineering judgment. Surely, we can think of more modern situations, like the space shuttle *Challenger*, in which such ballistic thinking has played a part.

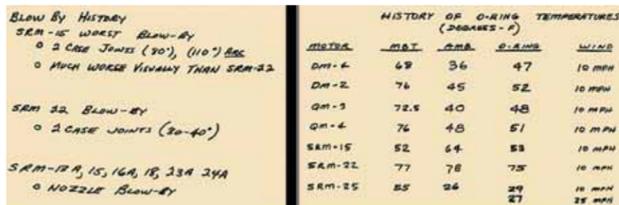
2. Communication is an ethical endeavor

Our management, our customers, and the public rely on our special knowledge as professionals. And clearly, our advice and our insights must be communicated to have an effect. To be effective, though, we must go beyond sharing information to sharing *meaning*, or interpretation. Recall, again, the case of the *Challenger*.

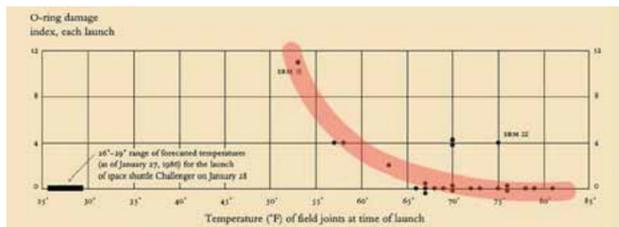


LIVES RIDE on the decisions made by engineers. Here, members of the space shuttle *Challenger* crew stand in the white room at Pad 39B following the end of the preflight Terminal Countdown Demonstration Test. From left to right they are: Christa McAuliffe, Gregory Jarvis, Judy Resnik, Dick Scobee, Ronald McNair, Michael Smith, and Ellison S. Onizuka. (NASA photo)

The spacecraft's engineers desperately needed to get across the seriousness of the effect of low temperature on the booster O-rings. Their plea was factual and passionate, but the temperature data was obscured by other data, making the relationship between temperature and O-ring failure unclear, and so the fateful launch decision was made.



Consider what might have happened if the following equally factual but clearer graph had been shown. The link between O-ring degradation and temperature is clear and compelling.



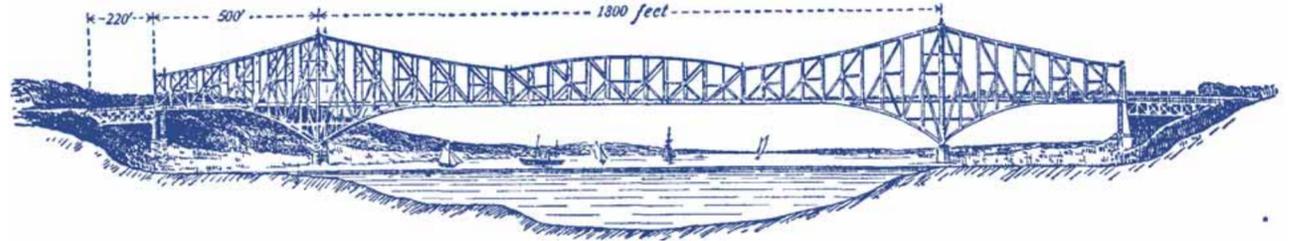
3. Consider the human factor

The burgeoning of automated systems has brought great benefits to quality of life of people everywhere, but it also has made more serious a longstanding conflict between human autonomy (self-governance) and machine automation (self-acting).

Case in point: The Airbus A320 was only indirectly controlled by the pilot, with software supplying the commands to the flight control elements. The A320 in the photo here crashed during a 1988 air show at Habsheim, France. Subsequent analysis determined that the aircraft's flight control software prevented the A320 from climbing out during a low-altitude maneuver. Had the human/machine interface been more effectively implemented, allowing the pilot to more readily assume control when necessary, the aircraft almost certainly wouldn't have been lost. As it happens, three of the 136 passengers on board the aircraft were killed.



THE AIRBUS A320 in 1988 was a new state-of-the-art aircraft that was a showcase for the integration of flight control software with pilot control. Three passengers were killed when the software didn't yield control of the aircraft to the pilot in a specific situation.



THE QUEBEC BRIDGE over the Saint Lawrence River was to have been the longest cantilevered span ever attempted. Critical considerations were omitted from the engineering plan. When the bridge

4. Plan: It's the essence of engineering

A plan is more than a project schedule; it is a product of deliberation in which the structure of the work, interdependencies, resources, and risks are defined, considered, and turned into a disciplined process for managing the work. Someone once said, "If you are failing to plan, you are planning to fail."

This deliberative character of planning is of crucial importance. This is the project phase, according to James Reason, author of *Human Error*, during which one runs the risk of making mistakes in judgment about the content and importance of necessary steps in completing a project. A tragic example is the planning and construction of the Quebec Bridge over the Saint Lawrence River. It was to be the longest (1,800 feet) cantilevered span ever attempted, yet the designer was so sure of his design approach, and the contractor was so short of funds, that critical calculations of the "dead load" (weight of the bridge itself) were left out of the plan. Furthermore, the project plan did not maintain clear responsibilities and authorities for work to proceed or to be halted, especially in view of the fact that the design engineer would not be on-site due to health problems. As the span continued to be built, the beams began to bend, but there was no definitive authority for stopping work. Then on Aug. 29, 1907, only minutes before quitting time, the bridge came crashing down, with 86 workers on site. Only 11 survived.



THE QUEBEC BRIDGE lies in a tangled heap after its collapse, which may well have been prevented with proper planning.

5. Obtain thorough, objective, and authoritative reviews of the work

The concept is simple: It is just too easy to overlook one's own mistakes. Reviews are not to be a box-checking exercise, but rather a value-added means to check our work. The Ariane V launch of June 4, 1996, was to be a glorious demonstration of the European Space Agency's capability in satellite deployment.

Instead, 36.7 seconds into the flight, one guidance software routine handed off control to another, incompatible one, and the result was a \$500 million, highly embarrassing disaster for the ESA.



THE HOPES AND AMBITIONS of the European Space Agency rode with the Ariane 5 in this 1996 launch. The rocket was intended to move the agency to the forefront of the satellite launch business.

The official finding of the ESA board reviewing the accident went right to the point: "The failure of the Ariane 501 was caused by the complete loss of guidance and attitude information 37 seconds after start of the main engine ignition sequence (30 seconds after lift-off). This loss of information was due to specification and design errors in the software of the inertial reference system."

The extensive reviews and tests carried out during the Ariane 5 Development Programme did not include adequate analysis and testing of the [software based] inertial reference system or of the complete flight control system, which could have detected the potential failure."

The software incompatibility encountered during the Ariane V launch was the type that could have been — and obviously should have been — caught in an appropriately planned set of reviews.

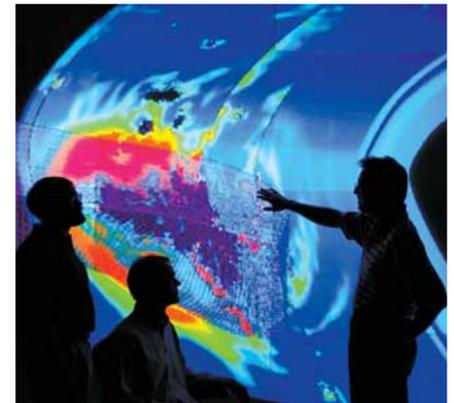
Those reviews should have been conducted by objective experts who themselves were not too close to or personally invested in the actual mission.

6. Know thy product (with apologies to Socrates)

The more we can do to establish an in-depth understanding of what we're engineering, the more we can gain insight into how the product functions, what's going on inside it, etc., the more we can discover and correct problems before they cause catastrophe.

As engineers, we gain insight through the models that we study, and here I mean models in a broad sense: theoretical, computational, and physical (testing). When invoked in a robust, balanced way, we can gain great insight. Today we have unprecedented capabilities in computational modeling that can make transparent what has previously been hidden behaviors of our systems, and therefore we have extraordinary new depths of insight available to us.

Sandia's computational and physical modeling expertise contributed greatly to the understanding of the shuttle *Columbia*'s problems during its fateful flight. Unfortunately, that insight and expertise were only sought out after the fact. We can now ask "What if this had been done earlier in the program?"



WHAT MIGHT HAVE BEEN the fate of the space shuttle *Columbia* if Sandia's modeling and simulation capabilities had been applied earlier in the shuttle program? (Photo by Randy Montoya)

7. Work with discipline and prudence

Engineering is a disciplined approach to the creation of things. Still, it is very tempting to take a shortcut because the rewards for doing this are pervasive, immediate, and temporary. Time and again we can trace a disastrous mishap to some deviation from accepted practice or an official procedure.

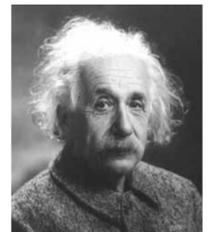


CHERNOBYL, the Soviet-era nuclear power plant that suffered a disastrous failure in 1986, stands as a stark reminder of the consequences of not doing things the right way from the start.

We would be wise to heed the advice of a former DOE quality official who told us to "beware of superstitious learning," which he defined to be those situations where we did something wrong, but everything turned out right, so we concluded that this is the way to do it.

Final thoughts

Having opened this essay with a statement by a prominent person, let me close with another. "Concern for Man [sic] himself and his fate must always form the chief interest for all technical endeavors in order that the creations of our mind shall be a blessing and not a curse to mankind. Never forget this in the midst of your diagrams and equations." — Albert Einstein



About the author

Executive VP and Deputy Labs Director John Stichman came to Sandia in 1972. Before assuming his present position, John was VP of Sandia's Weapons Systems division, where he was responsible for all aspects of Sandia's nuclear weapon engineering. John is a senior member of the Institute for Electrical and Electronics Engineers and is a recipient of the "Award for Exemplary Civilian Service" from the US Air Force.

John's published papers and conference presentations cover instrumentation and control, implantable medical electronics, and real-time optical computing. He holds two US patents.

John received a BS, MS, and PhD in electrical engineering from the University of Wisconsin. John plans to retire from Sandia in March.



39 Sandians move into Distinguished, Senior ranks

Divisions announce DMTS, DMLS, DTNG, DASA, Sr. Scientist/Engineer, Senior Administrator appointments

Sandia's special appointments represent employees from all areas of the Labs' operations: Senior Scientist/Engineers, Distinguished Members of Technical Staff, Distinguished Members of Laboratory Staff, Distinguished Technologists, and Distinguished Administrative Staff Associates. Thirty-nine Sandians were honored with special appointments in 2007.

According to Corporate Process Requirement documents, "Placement in the Distinguished Level signifies a promotion to the highest level of the Technical Staff, Laboratory Staff, Technologist, or Administrative Staff Associate Ladder. This level is different from the other levels in that it is subject to a 10 percent population limitation to preserve the distinction of the level."

Traditionally, one of the Labs' key "total rewards" incentives has been the quality of the folks who work here. Being able to offer prospective employees the opportunity to work with the most highly regarded people in their fields is a powerful recruiting tool. The individuals pictured here represent the world-class quality of the Labs workforce at its best.

Employees selected for the new levels have been recognized with a special plaque and a nonbase salary award, in addition to this special mention in the *Lab News*.

The Distinguished and Senior levels are part and parcel of the Integrated Job Structure (IJS) goal of providing multiple career paths for employees. The IJS's dual-track structure — management and staff — makes it possible for

employees to advance in salary, prestige, and recognition without following a management track.

As has been its tradition for many years, the *Lab News* presents photographs of Sandians who have received special appointments this year. Not pictured here are: Mark Ackerman (5928), DMTS; Don Jelinek (5354), DMTS; Jerry Stofleth (5434), DMTS.



DMTS — Distinguished Member of Technical Staff
DMLS — Distinguished Member of Laboratory Staff
DASA — Distinguished Administrative Staff Associate
DTNG — Distinguished Technologist
Sr. Sci/Eng — Senior Scientist/Engineer
Sr. Admin — Senior Administrator



Dennis Anderson
DMTS 6342



Thomas Ashwill
DMTS 6333



Viola Baca
DTNG 9542



Lydia Boye
DMTS 5928



Bill Breiland
DMTS 5713



Teresa Brown
DMTS 6322



Pauline Bruskas
DASA 10224



Raymond Byrne
DMTS 6473



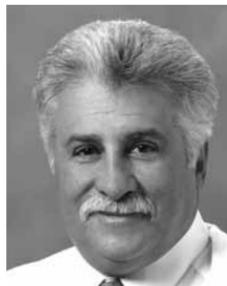
Julia Calderon
DASA 10513



Greg Christensen
DMTS 5765



John Dye
DMTS 5354



Paul Galbaldon
DTNG 12332



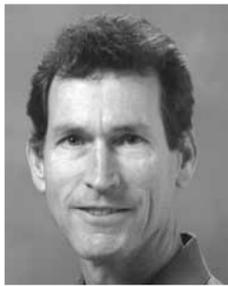
Ernest Garcia
DMTS 2614



Doug Ghormley
DMTS 5623



Loretta Humble
DASA 6051



Joe Jones
DMTS 6772



Patsy Jones
DMLS 12820



Wendell Jones
Sr. Sci/Eng 0500



Denise Krupka
Sr. Admin. 5765



Tim Lucero
DMLS 4221



David Marks
DMTS 5416



Patrick Ortiz
DTNG 4856



Cory Ottesen
DMTS 5356



Dave Outka
DMTS 5416



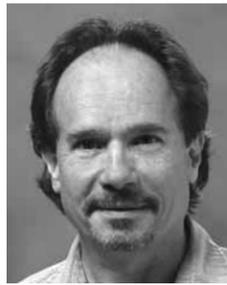
Paul Pickard
Sr. Sci/Eng 6771



Mahesh Rajan
DMTS 9326



Skip Reeder
Sr. Admin. 10200



Duane Schneider
DTNG 2453



Scott Slezak
DMTS 2132



Colin Smithpeter
DMTS 2137



Jeff Spooner
DMTS 5338



Dorothy Stermer
DMTS 0330



Bill Suderman
DTNG 4139



Rebecca Ullrich
DMLS 9532



David Wick
DMTS 6345



Steve Yearout
DMTS 5733



DEMOLITION DAY — Sandia and NNSA/Sandia Site Office officials wield golden sledgehammers to officially begin the demolition of Sandia's storied Compound Semiconductor Research Laboratory. Many of the functions of the CSRL have been incorporated into the new MESA facility. (Photo by Bill Doty)

Legendary facility comes down after decades of distinguished service

By Neal Singer

No one interceded when a number of Sandians with gold-painted, long-handled, six-pound sledgehammers attacked the white-painted cinderblock walls of one of the closest things to a national historic site at Sandia: the CSRL (Compound Semiconductor Research Laboratory) building.

At least one of the vandals expressed qualified remorse.

"There's always sadness seeing something that represented a big part of your technical life at Sandia going down. But look at the new MicroFab and Micro-Lab [of the MESA Center] taking its place," says senior manager Tom Zipperian (1740). "It was definitely a fair trade."

The building, first conceived as a storage building and completed in 1957, metamorphosed into the Laser Physics Lab in 1970, and — with Tom leading the way as staff project lead — into the CSRL in 1987.

"Zipperian was the visionary who turned the building into what it became for the next 20 years," says senior manager Bill Jenkins (8420).

Tom credits then-VP John Galt as the man responsible for the installation of "clean rooms" in the building; then-manager Paul Peercy for pushing the CSRL through to completion; and Roger Chaffin as another visionary on the project.

Though conceived as an interim facility expected to last only five years, the building and its innovative occupants persisted when an attempt in the early '90s to line-item a microtechnologies laboratory was killed for lack of program justification, says Tom.

The CSRL-based researchers used their borrowed time well. Workers at the lab were credited with discovering the unique electrical and optical properties of strained-layer superlattices and creating the first epitaxially grown monolithic vertical-cavity surface-emitting laser (VCSEL). It would be hard to overstate the importance of just these two discoveries to modern technology, and there were others.

The complex grew to include 6,500 square feet of class 100 clean rooms, nine epitaxial growth systems, electron-beam lithography, ion beam etching, and high-density plasma reactive ion etching.

In the divisions between research, development,

and application, CSRL was heavily weighted towards development.

But as the facility aged, it could no longer keep up with the increasing demands of modern research. The struggle to find funds to replace it, led by Senior VP Al Romig, President Tom Hunter, and others, got an odd but effective boost when Sen. Pete Domenici — a supporter of Sandia and the replacement MESA project — reported that a toilet had crashed through the rotted floor of one of the trailers housing research offices surrounding the building.

While it may (as one politician puts it) "take a village to raise a child," it will take the gleaming modern multistory MESA buildings to replace that cramped but creative place.

Others participating in the token demolition effort, led by Executive VP Joan Woodard (0002), included MESA Director Mike Cieslak (8400), DOE Sandia Site Office Manager Patty Wagner, Director Gil Herrera (1700), and federal project director Jeannette Norte. SSO Assistant Manager Mike McFadden participated, as did Ron Jones (1741), Tim Frock (17412), and members of the MESA Project team.

Defense Support Program launches 23rd and final satellite

DSP-23 will send back mission and 'space weather' data for years to come

By Stephanie Holinka

Last November, the Defense Support Program launched the 23rd DSP satellite into orbit. DSP-23 is the last DSP satellite — the last of a long line of radiation detection (RADEC) and Advanced RADEC payloads that have provided more valuable data for US national security than its designers could have ever anticipated.

Every system provided for DSP by Sandia has operated without failure and far beyond the originally estimated life of three years. Some satellites have lived more than 17 years, continuously relaying useful information to users on the ground. All of the DSP satellites are still in orbit although many are nonoperational. Paul Beck, retired Sandian and unofficial DSP historian, says, "The lifespan of these satellites has far outweighed their original requirements."

DSP was part of the space-based early warning system (SBEWS) and replaced the older VELA system. DSP was intended to provide early warning for incoming intercontinental ballistic missiles and sea-launched ballistic missiles. The satellites also allowed national

security groups to detect both endoatmospheric and exoatmospheric nuclear detonation events.

DSP's "moment of glory" came during the Persian Gulf War during Operation Desert Storm. US Space Command (USSPACECOM) in Colorado Springs, Colo., used data from a constellation of DSP satellites to detect incoming Scud missiles, providing timely warning to civilians and coalition forces. The warnings allowed Patriot missile battery commanders in Saudi Arabia and Israel to stage timely responses. Older RADEC systems used visible light detectors to look for events and provided analog data. "RADEC 1 was a pretty crafty device,"



SANDIA'S DSP-23 TEAM

says Rick Pepping (5715).

The Advanced Atmosphere Burst Locator (AABL) provided event locations. Other RADEC sensors provided time and waveform information. One innovation in the system tester on the ground introduced a modern hard drive for the system software, replacing a basketball-size platter that held just 5 megabytes, but was sufficient to hold the entire operating system.

RADEC systems include a variety of environmental detectors whose reliability and sensitivity have provided voluminous data to scientists in a variety of disciplines. Environmental data were provided to the US Air Force Weather Service for dissemination to interested groups.

This last launch was the most stressful for everyone, says Dennis Lierz (5715). Except for a single deployment from the space shuttle *Atlantis* in 1991, the DSP satellites have been deployed using Titan-series boosters. For this last DSP, the program had run out of

Titans. That meant a delay as the team waited for a new booster to deploy the final satellite. The designated booster was the new Delta IV-Heavy, built by United Launch Alliance. DSP was the first mission-capable payload to be delivered by the new booster, which meant the satellite launch would be subject to any schedule delays as the new system was qualified. A demo launch of the new booster identified multiple technical issues, leading many to wonder if this last satellite would ever get off the ground.

Dennis spent most of the last two and a half years at Cape Canaveral as the technical liaison between Sandia/Los Alamos National Laboratory, the other satellite contractors, the launch vehicle contractor, and the Air Force customer. The satellite finally arrived in Cape Canaveral in May 2005 after its long journey from Northrop Grumman Space Technologies in Los Angeles. It was with great relief that he saw the last successful launch, Dennis says.

Paul Beck says he has the names of more than 400 Sandians who have worked on the DSP project since its inception in the early 1970s. "Many scientists and engineers spent the majority of their Sandia careers on the project," Paul says. Though a few people are still working to close down the remote sites, most of the remaining Sandians have been reassigned. Many others are retired.

This last launch does not mean that the project ends. DSP's work has been going on for nearly 40 years and will continue for years to come. Ground crews at Sandia and other locations will monitor the satellites for the remainder of their mission lives. Rick says that Sandia's responsibility for these systems is "cradle to grave," and the most recent DSP is still an infant.



PRESIDENT KENNEDY being briefed on the VELA satellite's capabilities during a visit to Sandia in 1963.



A NEW RIDE — DSP-23, mounted atop a Delta IV-Heavy booster at Cape Canaveral, is the last in a long line of Defense Support Program satellites.

Mileposts

New Mexico photos by Michelle Fleming
California photos by Randy Wong



Tamara Orth
30 4220

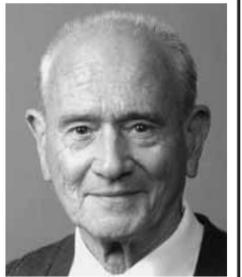


Carol Amedeo
25 5255



Michael Swanson
25 5339

Recent Retirees



Alfred Foster
51 5431



Martha Trujillo
20 11100



Gregory Vawter
20 1742



Marjorie Kirkel
15 5253



Dwayne Knirk
15 12341



Kathy Silva
15 2020



David Renninger
41 1735



Jeff Tingley
37 2452



50 years ago . . . Sandia Corporation's 1,700 engineers and scientists were among thousands of technical people across the nation being honored during National Engineers Week, proclaimed by President Eisenhower for Feb. 16 to Feb. 22.

40 years ago . . . A new "bubble-top" recovery system for Sandia rocket test vehicles impacting on water has been developed. The heart of the new system is a spherical ram-air bag that is stitched around a hole cut in the center of an eight-foot-diameter parachute canopy.

As the parachute is pulled earthward by the weight of the payload, air caught under the chute's canopy is forced through the hole to inflate the neoprene coated balloon-like bag. After impact on the water, the hole between the bag and the chute is sealed so the bag remains afloat.



HOLDING THE BAG that houses the new recovery system on rocket flights, Don Johnson explains packing procedures.

Sandia used the Sandia Peak Tramway for a special terrain measurement project of Advanced Radar Development. The study was undertaken to determine characteristics of radio frequency return signals from uneven terrain. Strength of return signals varies with surface characteristics.



UP, UP, AND AWAY — The Sandia Peak Tramway was used by Sandia for a special terrain measurement project.

30 years ago . . . Final exams on Sandia Livermore's Variable Displacement Engine (VDE) indicated that its design and concept were indeed feasible. The engine, invented by Harvey Pouliot, reduced fuel consumption at low power levels by reducing throttling and friction losses. Its unique feature is a mechanical linkage that enables the driver to change at



ASSEMBLING THE CRANKCASE of the Pouliot Variable Displacement Engine prototype.

will the length of the piston stroke and thus adjust the horsepower of the engine to meet the varying demands of the driving situation.

An experiment to test a special technique of preparing an oil shale bed for in situ retorting — under-

ground combustion that transforms solid hydrocarbon into liquid oil — was conducted near Rock Springs, Wyoming. Both hydrofracture techniques and explosive slurry were used to rubblize an underground oil shale formation.

20 years ago . . . For the first time, Sandia originated a live teleconference and transmitted it, via satellite, to universities and industries across the country. Several members of Continuing Technical Education and Training Division, Motion Picture-Video Services Division, and KOB-TV made the conference possible. KOB's "NewsStar 4" remote broadcast unit took the TV signal, via cable, from the Technology Transfer Center control room and uplinked it to satellite G-Star I in geosynchronous orbit 22,300 miles above the Earth. From there, the signal was retransmitted over the entire US and could be picked up by organizations that had subscribed to the conference through the NTU/AMCEE network.

10 years ago . . . Researchers at Sandia's Z have increased the machine's X-ray power output by nearly 10 times in the past two years. The most recent advance resulted in an output X-ray power of about 290 trillion watts — for billionths of a second, about 80 times the entire world's output of electricity.

Archimedes 3.0 is the latest and most advanced version of a Sandia-developed planning and visualization software tool that generates, optimizes, verifies, and examines sequences of mechanical assembly



GASES VENT through two well bores as nearly 7,000 kg of slurry explosive rubblize an oil shale formation during an experiment near Rock Springs, Wyoming.



A SAMPLE OF ARCHIMEDES 3.0 SEQUENCE for the B61 tail assembly appears on the screen, while an actual tail assembly is in the foreground. (Photo by Randy Montoya)

by directly exploiting three-dimensional computer-aided design (CAD) models.

Sandia scientists developed the first reproducible quantum transistor

through a process called "tunneling." Electrons "tunnel" from path to path through a barrier that, in classical physics, is impenetrable. The device, dubbed DELTT (Double Electron Layer Tunneling Transistor), offers promise of significant improvements in the speed of computers and in the accuracy of sensors.



QUANTUM MECHANIC — Jerry Simmons inspects the end of a cryogenic sample holder for performing electrical measurements on the DELTT quantum mechanical transistor. (Photo by Randy Montoya)



'Go to school' mantra from coworkers brings David Cain to Sandia, where the world got big

By Iris Aboytes

When David Cain (1733) accepted a summer internship through Sandia's Science and Technology Outreach program, the first thing he did was find a map. He wanted to see if New Mexico was really in the United States. "My friends cautioned me not to drink the water," he says.

David says being recruited by Sandia was the real turning point in his life. "That is when the world got big," he says. He worked at Sandia every summer until he earned his BS in industrial technology from North Carolina Agricultural and Technical State University (NC A&T SU) in 1991, when he became a Sandian.

Over the past 17 years David has worked in both weapon systems and component groups, and is currently the leader of a product realization team in Dept. 1733.

David grew up in a single-parent household in Weeksville, N.C., a small rural community in the northeastern part of the state. By the time David was 12 years old, he and his sisters worked on large produce farms during the summers and on weekends. "Though just 27 years ago, the scene was something out of the 1800s, complete with white-columned farm houses surrounded by tall oak and whispering pine trees," says David. "Trust me. It was not as charming as it sounds."

A cramped smoke-filled Volkswagen minivan cruised the neighborhoods seeking willing workers. David packed corn, grated potatoes, and cut and packed cabbage.

"My mother, Martha, was a beautiful woman who

was truly the heart of our family," he says. "She wanted to be remembered as a strong woman of great faith who raised her family on good Christian values. She was proud to have raised three children who never did drugs, never spent a night in jail, and all embrace her legacy of faith. This she did while suffering from debilitating disabilities and while on a fixed income.

"Winters were cold and summers were hot," says David. "As a kid, I remember thinking conditions were unbearable, I was determined to leave the fields behind for a better life. Even the older people in the van had 'go to school' as their mantra."

When David was a senior in high school, a cousin casually asked what he was

going to do after graduation. David told him of his plan to escape the fields and small-town life by learning a trade, like some of his other relatives. "My cousin asked why I wasn't planning to go to a four-year university and get a bachelor's or maybe even a master's degree," says David. "My cousin insisted that universities were not just for the rich or elite. It was as if a light bulb came on. That is all it took."

After graduating from high school, David left Weeksville and drove the highways for the first time in his life — alone. He found his way to Greensboro, N.C., and attended NC A&T SU. "I did not think I was smart," says David. "I was definitely not rich. I did not come from the big city. How could this possibly work? Many students at the university came from large cities like Baltimore, Washington, D.C., and New York. They laughed at me for asking, 'Are y'all



DAVID CAIN'S journey from rural North Carolina to Sandia has provided him an opportunity to render exceptional service in the nation's interest. (Photo by Bill Doty)

February recognized as Black History Month

Black History Month has been celebrated annually since 1926, first as Negro History Week and later as Black History Month.

Carter G. Woodson, born to parents who were former slaves, spent his childhood working in the Kentucky coal mines and enrolled in high school at age 20. He graduated within two years and later went on to earn a PhD from Harvard.

Woodson decided to take up the challenge of writing black Americans into the nation's history. He established the Association for the Study of Negro Life and History (now called the Association for the Study of Afro-American Life and History) in 1915, and a year later founded the widely respected *Journal of Negro History*. In 1926, he launched Negro History Week as an initiative to bring national attention to the contributions of black people throughout American history.

Woodson chose the second week of February for Negro History Week because it marks the birthdays of two men who greatly influenced the black American population, Frederick Douglass and Abraham Lincoln.

going to the cafeteria? They wondered what y'all meant. I quickly stopped saying that."

It was not long before David was competing with these kids. When one of the star basketball players asked David to help him with his studies, David finally realized he had something to offer. He knew he had "arrived."

Everything changed for him after a professor talked to him about a national laboratory that was offering summer internships in New Mexico.

"It's hard to believe," he says. "I have traveled to Europe for Sandia, and I have visited and worked in facilities all over this country. I have gone from not flying on an airplane to seeing the F-117 stealth fighter test flights before it was declassified to the public. I am proud I have contributed to Sandia's mission to ensure the safety and security of this nation."

Donating blood: Unselfish giving just takes a little time and a little effort

By Iris Aboytes

Four units of blood were needed in surgery recently as doctors repaired head injuries to a 4-year-old after a car accident. Six to 20 units of platelets are used each week by an 18-year-old girl with lung cancer. Ten-year-old Juliann receives six to 20 units of platelets a week to battle a rare form of cancer. Two women, 24 and 42, each require 20 units of blood each day.

United Blood Services (UBS) furnishes blood to all area hospitals. During January, USB had to import 100 to 150 units of blood each week from Arizona. "The flu season, coupled with our inability to reach blood donors in the northern part of the state because of the weather, have contributed to our shortage," says Evelyn Bryan, the donor recruit manager for UBS. "During the summer months vacations are a primary focus and blood donations come down. Shortages do not usually occur at this time of year."

Make an appointment

The days of long lines and long waits to give blood are gone. Appointments can now be made online, making waits minimal. UBS has been given the green light by the US Food and Drug Administration to begin using a simplified health history interview that will cut interview time by 30 percent. That process will begin in March.

In addition to donors being checked for blood pressure and anemia, cholesterol analysis is now being done and results can be accessed online. Testing is also done for hepatitis B, HIV, and several other diseases.

The requirements for donating blood are fairly simple. Do you weigh 110 pounds? Have you had a healthy breakfast? Are you healthy today? If your answers are

"yes," then you qualify.

Rewards can be instantaneous and music to your ears. Make your next meal a hearty one, says the phlebotomist, and no high-impact exercise for 24 hours. The real reward comes from knowing you have made a difference in a needy stranger's life.

Appointments are available for Sandia's weekly blood drives at different locations. For more information on UBS and Sandia's schedule, go to <https://www.bloodhero.com/index.cfm>. Sandia's codes are SNL, SSTP, and IPOC.

The two women requiring 20 units of blood each day? Doctors have not been able to discover why their bodies do not produce enough red blood cells. Without the daily transfusions, they would not survive. Maybe that is why UBS calls blood donors heroes.

Blood donations at Sandia

- 2005 – 1,600 units
- 2006 – 1,200 units
- 2007 – 1,000 units

Blood components

- Red blood cells are used for loss during surgeries, to treat anemia, etc.
- Platelets help control bleeding and are used in cancer patients.

Blood types

- O positive/negative (45 percent) Universal Donor, most needed
- A positive/negative (40 percent)
- B positive/negative (11 percent)
- AB positive/negative (4 percent) Universal Receiver

Feedback

How much will employees be contributing to the pension plans?

Q: In Tom Hunter's all-hands meeting, he mentioned a potential rise in operating costs due to pension liabilities of \$100 million in 2011. What was not clear was the plan for covering this cost. It would be helpful to employees, for their own planning purposes, to understand what this plan is and if it will require any monetary obligations on their part. I've heard that each employee will have to begin to pay into the pension. What percentage of his/her salary will the employee be required to pay into the pension under this plan? If you don't have a specific percentage planned, do you have a range? What will the company pay? What are the estimated pension operating costs for 2012 and beyond?

A: Although Sandia's pension plans required mandatory employee contributions before July 1975, the company has been solely responsible for any required pension contributions since that time. The pension plans don't currently require or allow employee contributions, and Sandia is not actively considering at this time a change in that policy.

The contributions due for any year are based on a valuation of the pension plans' assets and liabilities performed by Sandia's independent actuary. Our most recent projection indicates that Sandia will be required to make new contributions to the Retirement Income Plan beginning in FY11. By FY12, we estimate that in the most likely case Sandia could be required to make \$113 million in pension contributions. However, any of these projections can change during the intervening years due to the inherent volatility in the capital markets. The actual contribution due for any given year won't be known until that year when the actuary completes the valuation of the plans' assets and benefit obligations. — Mark Biggs (10520)